



**Arkansas Public Health Pandemic Working Group
Mark L. Williams* and the COPH COVID-19 Research Team
Jan. 17, 2022**

* corresponding author

COVID-19 Forecasts, Projections, and Impact Assessments

The University of Arkansas for Medical Sciences' (UAMS) Fay W. Boozman College of Public Health (COPH) faculty conducted four types of assessments for this month's report: 1) a look at the pandemic in Arkansas from a longer-term perspective; 2) forecasts and projections of cases and maps of community spread; 3) forecast models of hospitalizations; and 4) forecast models of COVID-19 deaths. In this report, we are no longer reporting on immunizations in Arkansas. These data are available from other sources.

All forecasts and projections were developed using COVID-19 data from the Arkansas Department of Health through Jan. 16.

Summary points are:

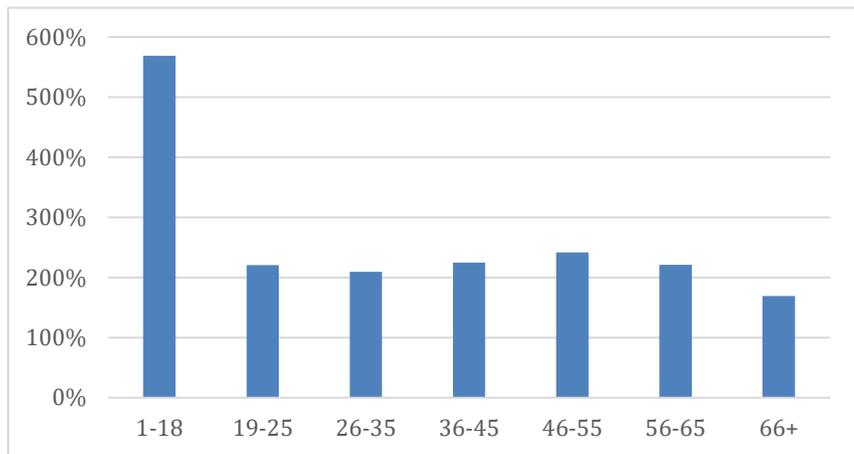
- The models are forecasting an increase in new daily COVID-19 cases in the state — forecast to increase from 9,529 cases on Jan. 18 to 22,672 on Feb. 15.
- The 30-day models continue to show Arkansans between ages 35 and 59 will have the highest number of COVID-19 diagnoses — forecast to increase by 150,731 cumulative cases by Feb. 15.
- COVID-19 cases in children 17 and younger are forecast to increase nearly 89% by Feb. 15, adding 112,844 cumulative cases.
- The model forecasts an increase in daily hospitalizations over the next 15 days, from 96 to 180 new admissions per day.
- The 30-day model is forecasting an average of 12 COVID-19 deaths per day for the next two weeks.

The models are showing we should expect COVID-19 cases, hospitalizations, and deaths to continue to increase through Feb. 15. Models are based on past data, and do not account for increases or decreases since the data were pulled on Jan. 17. The Omicron surge is not over.

When viewing the figures in the report, what is important to focus on is the trends, not the numbers. Increases must be taken in light of patterns over the last few months.

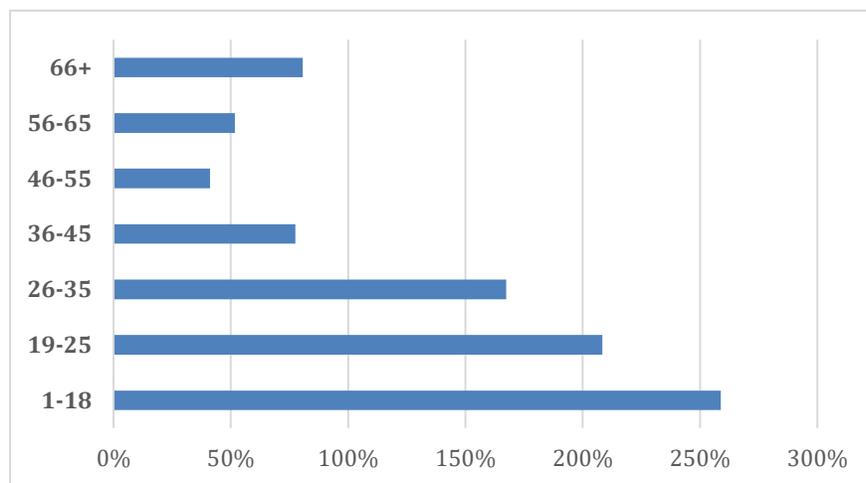
As shown in Figure 1, cases have increased an average of 265% during the last month compared to the previous month. The highest increase in cases was in children 1 to 18, increasing by 569%. Almost all other age groups increased by more than 200%. This is demonstrated by an increase in the average daily cases from 4,008 to 14,757.

Figure 1. Percent change in cases from 12/20-1/2 to 1/3-1/16



Hospitalizations also significantly increased over the last month by an average 127%. Hospitalizations increased in children 17 and younger by 208% and by 167% in adults 19 to 25, as shown in Figure 2. Almost

Figure 2. Percent change in hospitalizations from 12/20-1/2 to 1/3-1/16



all other age groups increased by more than 50%, as demonstrated by an increase in the average daily hospitalizations from 82 to 153.

Projecting the course of the pandemic in Arkansas, and most likely all other states, will be made more difficult with the widespread use of at-home tests. Results of at-home tests for most will be private, and, thusly, not included in the number of

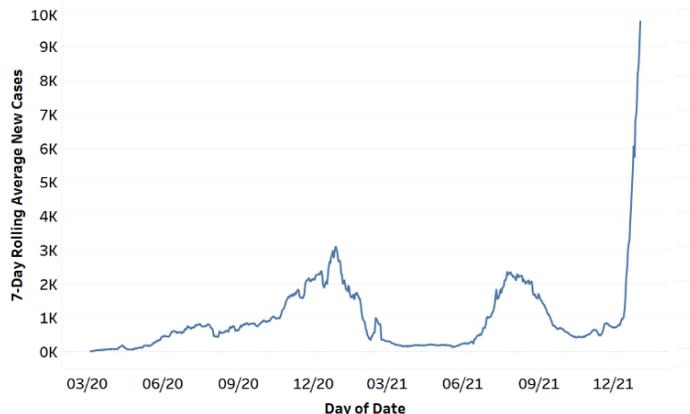
cases reported to the Arkansas Department of Health (ADH). The result will be that models forecasting case trends, which use case data, will be less reliable and likely significantly under project the number of actual cases.

The current surge, which will likely continue well into February, will have an impact on the state's economy. The number of people ages 18 to 59 infected, the bulk of the working population, as we head into February will continue to increase. As has been widely reported in the media, hospitals are having difficulties keeping their facilities fully staffed. Ancillary services directly connected to hospitals, such as ambulance and other emergency services, will likely run into staff shortages due to COVID illness. Wait times for ambulances may significantly increase and drivers and EMT personnel are out sick or in isolation. The state should also expect a high rate of teacher sick time because of Omicron illness or exposure. In short, before this surge is over, staff shortages due to COVID will impact all sectors of the economy.

The COVID-19 Pandemic in Arkansas

Figure 3 shows the seven-day rolling average of new infections since March 2020. Daily numbers are often considered too “noisy” to accurately reflect an epidemic’s growth. To address this noise, we use rolling averages to smooth out meaningless daily differences in infections.

Figure 3. Seven-day rolling average of daily COVID-19 cases



What is easily discernable from data plotted in Figure 3 is that Arkansas is experiencing a COVID-19 wave that far exceeds previous COVID-19 waves in the state. Prior to 2022, the month with the highest monthly average of new cases per day was January 2021, which saw an average of 2,262. To date, in the first 2.5 weeks of 2022, Arkansas has experienced an average number of new daily cases equal to 7,168.

Figure 4a shows the COVID-19 testing rate per 1,000 persons in Arkansas. Since September, the testing rate had significantly declined. With the recent surge in cases at the end of December, testing has significantly increased. On Jan. 12, the state performed 7.4 tests per 1,000 persons, which is slightly lower than the national average of 8.8. Without regular, widespread testing and reporting

of cases to ADH, which is the best data for estimating the spread of disease in a population, forecasting future cases, hospitalizations, and deaths is more difficult.

The COVID-19 positivity rate is an indicator of viral transmission. The positivity rate is the number of people who test positive for COVID-19 as a proportion of the number of people tested. A higher positivity rate is indicative of higher transmission relative to the number of tests. A higher state positivity rate and relatively low testing level raises serious concerns about our ability to know the “true” number of COVID-19 cases in the state.

Figure 4a. COVID-19 testing rate per 1,000 through Jan. 12

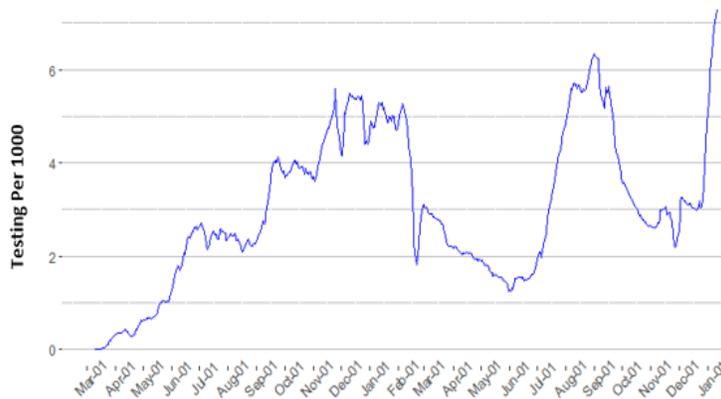


Figure 4b shows the seven-day moving average of the positivity rates for Arkansas and the United States. The positivity rates in Arkansas and the U.S. have spiked during recent weeks due to the Omicron variant. Both positivity rates are above 25%. Since the last report, the state's positivity rate has increased to 32.5%, which is above the national average of 25.9%. However, both the per capita testing rate and the positivity rate should be considered in light of no active surveillance either statewide or nationally. With the new Omicron strain, it remains to be seen whether positivity rates will increase in coming days both at state and national levels.

Figure 4b. COVID-19 positivity rates through Jan. 12



COVID-19 Cases

PCR tests are the gold standard for identifying COVID-19 cases and probable cases are diagnosed using an antigen test. Results of antigen tests have been reported by the ADH since Sept. 2, 2020. ADH continues to distinguish between confirmed and probable cases, but they are combined for this report. Throughout the report, confirmed and probable cases are “cases.” For this report, we used data from Nov. 1 to ensure more stable models.

Forecasts of COVID-19 cases in Arkansas. New daily cases for the period Jan. 17 to Feb. 15 are shown in Figure 5a. Estimates are realized rates. As shown in the figure,

Figure 5a. New COVID-19 cases

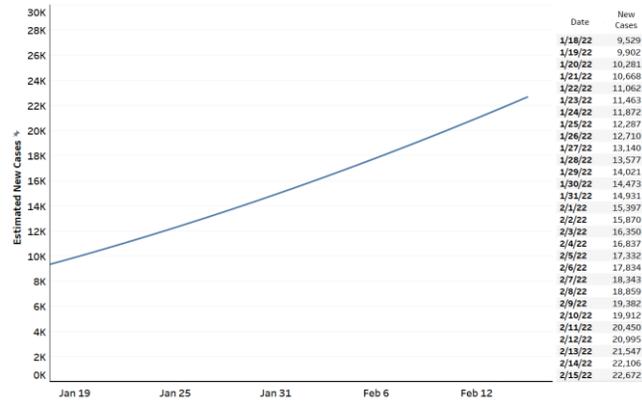
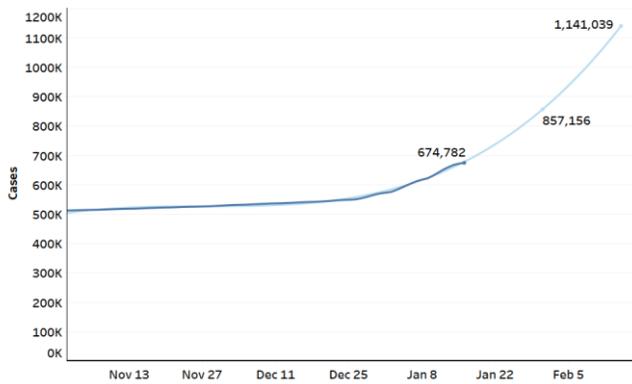


Figure 5b. Cumulative COVID-19 cases through Feb. 15



the model is forecasting a drastic daily increases in new cases. New COVID-19 cases are forecast to increase from 9,529 on Jan. 18 to 22,672 new cases on Feb. 15.

Figure 5b shows the forecast of cumulative COVID-19 cases through Feb. 15. The 30-day cumulative forecast shows Arkansas will surpass one million COVID-19 cases around Feb. 9, reaching 1,141,039 cumulative cases by Feb. 15.

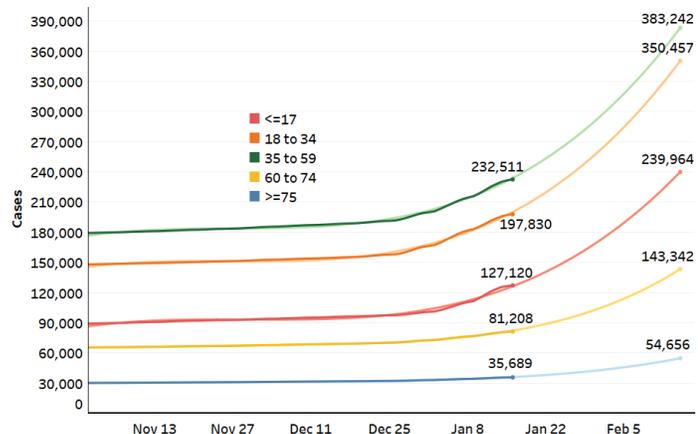
There are small variations in growth patterns across groups. The least amount of growth will be in Arkansans 75 and older. This could be for a number of reasons, including less time in public spaces and higher rates of vaccination.

The age group with the greatest increase in cases will be Arkansans 35 to 59. This age group will add about 150,731 new cases by Feb. 15, averaging 5,024 new cases per day. The group with the second highest growth in cases will be young adults age 18 to 34. The model is showing an additional 152,627 will contract COVID by Feb. 15. This is an average of 5,087 new cases per day.

Children 17 and under, although third in terms of absolute numbers, will show continued high growth in cases. The model

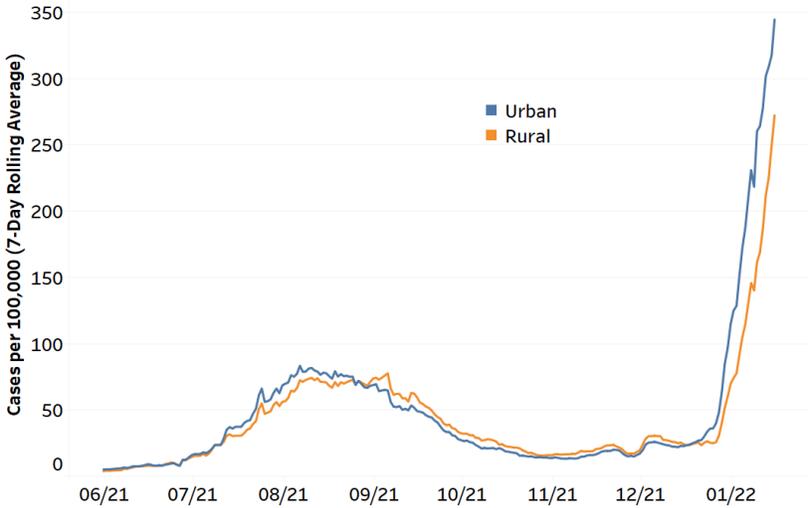
Forecasts by age. As shown in Figure 6a, the forecast of cumulative cases by age groups shows steep increases in every age

Figure 6a. Cumulative COVID-19 cases by age through Feb. 15



forecasts around 112,844 new COVID cases in children through Feb. 15, an average of 3,761 new cases per day.

Figure 6b. Seven-day rolling average of daily COVID-19 cases by rural/urban



As shown in Figure 6b, case rates per 100,000 among rural and urban counties have been similar across the pandemic, until recently. Presently, urban counties have a 27% higher 7-day rolling average of new COVID cases compared to rural counties.

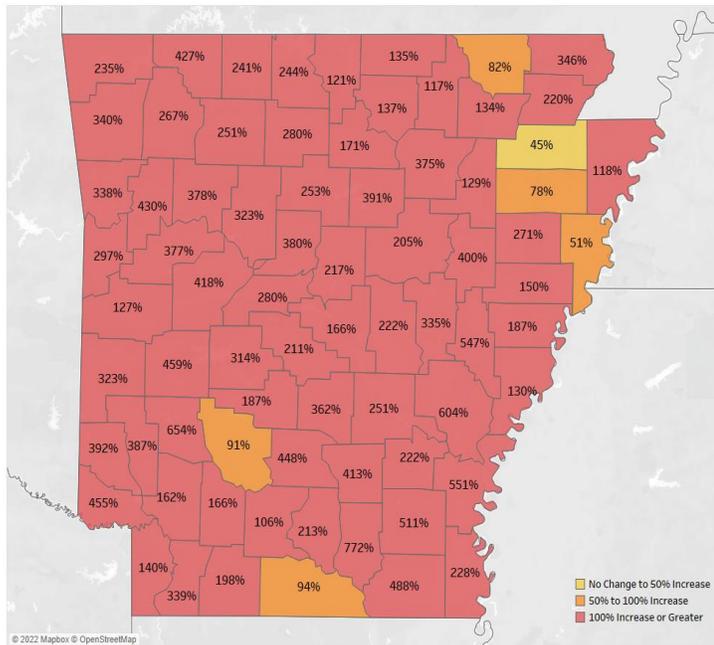
Relative change in COVID-19 cases by county. Map 1 below shows the relative change in COVID-19 cases across Arkansas counties in past two weeks. Relative change is calculated

as the percent change between cases during the most recent two-week period (Jan. 3 to 16) compared to cases from the prior two weeks (Dec. 20 to Jan. 2).

The relative change in cases presents the most definitive pattern we have seen across the state in some time. All but six counties report relative change rates for the last two weeks above 100%. The largest relative increase in COVID-19 cases was in Bradley County, with a relative increase of 772%. No county in the state reported a relative decline in COVID cases.

As shown on Map 2, on the next page, all counties in Arkansas had elevated per capita COVID-19 cases between Jan. 3 and Jan. 16. Per capita case rates ranged from 19 to 310 cases per 10,000 persons. Twenty-three counties had case rates above 100, and three counties above 200. This is much different compared to September, when only two counties had per capita case rates greater than 30 per 10,000.

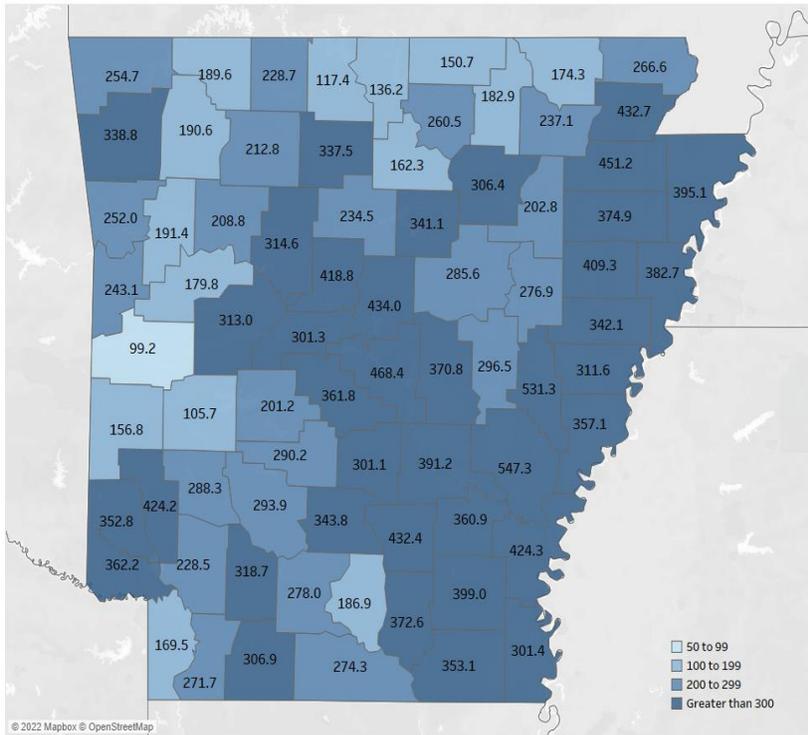
Map 1. Relative change in COVID-19 cases



Summary. The 30-day models are forecasting exponential growth in COVID-19 cases in Arkansas through January and into February. Increases in cases will be well above rates seen during the 2020-2021 winter and the 2021 summer surges.

Case data show a clear shift in the pandemic toward younger adults and children. The number of cases in children is showing exponential growth, which is unlikely to decline in the next month. The approval of vaccines for children should have had a positive impact on the number of cases in children. However, vaccinations among children are lower compared to other

Map 2. COVID-19 two-week per capita case rate



age groups. This presents an almost perfect situation for viral spread. Research shows that children in schools with less than perfect public health prevention measures in place are transmission sites for all sorts of viruses. Children will bring viruses home to their families. With children returning to in-person education in the state, a major concern for public health officials should be within family spread of Omicron.

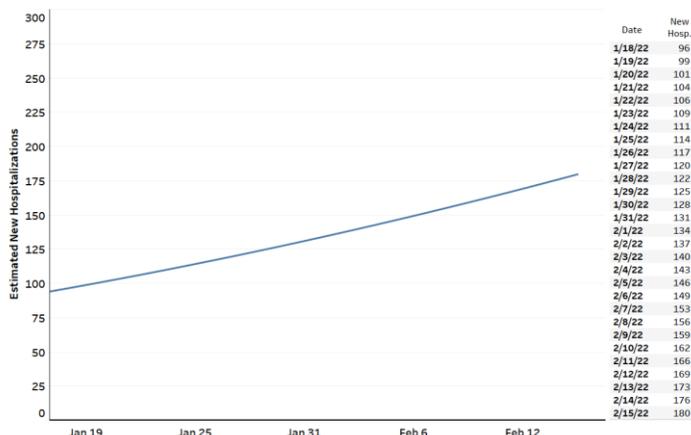
The surge is having an impact on all age groups. The highest number of new COVID cases will be in adults 35 and 59, as it has been through much of the pandemic. Young adults 18 to 34 will also experience high

rates of new cases.

The surge in COVID cases is not localized to any region in Arkansas. It is widespread throughout the state. All counties in the state are classified as extremely high risk for COVID spread. The relative change in cases in the last two weeks compared to the previous two weeks is as high as 772%, a number not seen in either of the two previous surges. This percent demonstrates how quickly Omicron is being transmitted.

COVID-19 Hospitalizations

Figure 7a. New daily hospitalizations



30-day forecasts of hospitalizations.

Figure 7a shows the realized rate of new hospitalizations in Arkansas between Jan. 17 and Feb. 15. As is easily discernible from the figure, there will be a constant increase in daily hospitalizations. The average new hospitalizations per day will be 138, increasing from 96 Jan. 18 to 180 on Feb. 15.

The 30-day forecast for cumulative COVID hospitalizations is shown in Figure 7b. The model forecasts a total of 35,099 cumulative hospitalizations by Feb. 15, an increase of 4,192 patients.

Figure 8 shows the 30-day forecast of hospitalizations by age group through Feb. 15. As is evident, hospitalizations in all age groups will increase. The age group with the most hospitalizations will be adults 35 to 59, adding 1,272 new patients in the next 30 days. A large proportion of patients will also be adults 60 to 74. The model forecasts this group will add 929 new patients by Feb. 15.

Summary. Hospitalizations will continue to increase during the next month, with significant numbers of new patients across all age groups. The models forecast the greatest number of hospitalizations due to COVID-19 will be adults 35 to 59 followed by adults 60 to 74.

Figure 7b. Cumulative hospitalizations through Feb. 15

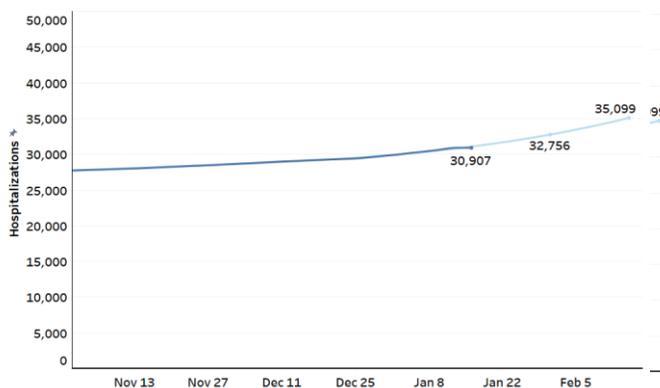
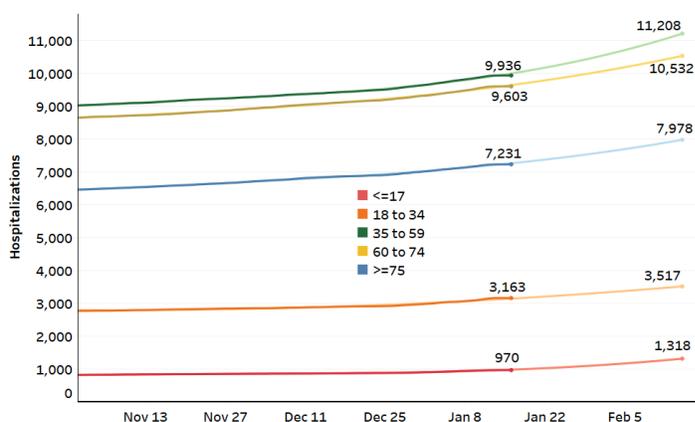


Figure 8. Cumulative hospitalizations by age group



We also expect greater numbers of young adults 18 to 34 and children under 17 will be hospitalized. Actual numbers of young adult and pediatric patients will remain lower than older age groups. The model forecasts 348 new pediatric patients by Feb. 15.

COVID will continue to stretch hospital staff by creating staff shortages. We continue to put our health care workforce at risk of burnout.

COVID-19 Deaths

30-day forecast of COVID-19 deaths. Figure 9a shows the realized rate of new COVID-19 deaths in Arkansas from Jan. 17 to Feb. 15. The model forecast 11 to 13 deaths per day through Feb. 15.

Figure 9b shows the 30-day model forecast 9,489 cumulative deaths in Arkansas due to COVID-19 by Feb. 15. The model is forecasting 398 new COVID-19 deaths over the 30-day forecast.

Summary. The number of daily deaths from COVID-19 appears to be relatively stable at 12 deaths per day.

Deaths lag both cases and hospitalizations, which suggests the number of deaths should begin to increase more rapidly, if the trend in cases and hospitalizations continues to increase.

Figure 9a. Daily COVID-19 deaths

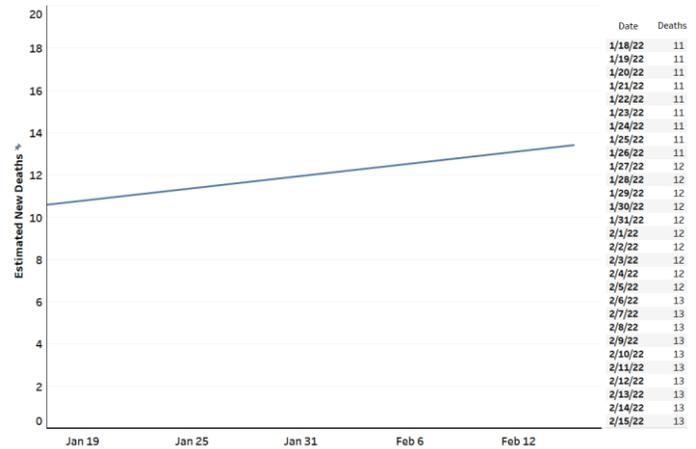
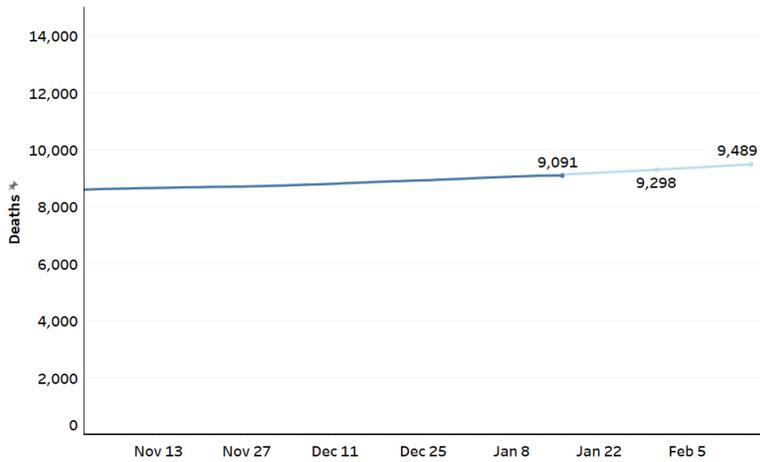


Figure 9b. Cumulative COVID-19 deaths through Feb. 15



The models forecasting daily and cumulative deaths are lagging behind the growing death count in the state, and illustrate the challenges of using modeling data. Forecast models use past data. They cannot use data that become available after the model is run. Consequently, these models appear to be reporting a slower trend in deaths than would be indicated by more recent data. As of Jan. 16, there have been 9,434 actual COVID-19 deaths in Arkansas. The increasing number of COVID-19 deaths is not

unexpected, as indicated by the trend lines in both Figures 9a and 9b.

Methodological Notes

Short-term forecasts. Time series forecasting is a method that uses observed data to predict future values. The purpose of the models is to fit the best curve to data and extend the curve into the future. To forecast aspects of the pandemic in Arkansas, the models used COVID-19 cases, hospitalizations, and death data reported to the Arkansas Department of Health. It should be noted the report defines a “case” as a COVID-19 test result reported and posted by the Department of Health. As indicated by recent research, the number of undiagnosed COVID-19 infections in the community may be higher by 40% to 50%.

Glossary of Terms

Active infection = a positive infection, with or without a COVID-19 test, that has not yet recovered or died

Case = a positive COVID-19 test result reported to the Arkansas Department of Health

Community = population not in a prison or population not in a prison or nursing home

Cumulative = total number of a given outcome (e.g., cases) up to date

Extended state-space SIR (eSIR) model = a model based on three components: susceptible (S), infected (I), and removed (R, including both recoveries and deaths)

Susceptible-Exposed-Infected-Recovered model (SEIR) = another variant of standard epidemiological model considering exposure as another factor controlling for disease dynamics

Hospitalization = a positive infection or case that was admitted to the hospital

Infection = a COVID-19 infection, with or without a test and regardless of having recovered or died

Positivity Rate = the number of people who test positive for covid-19 as a proportion of people have been tested

Projections = long-term predictions

Recovered = a positive infection that is no longer symptomatic or shedding virus

Susceptible = an individual who can be infected with the disease of interest

Time series forecast = short-term forecast of events through a sequence of time